HIGH-GRADE TIMOTHY AND CLOVER HAY:

METHODS OF PRODUCING, BALING, AND LOADING FOR MARKET

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EMPHASIS now placed on the necessity for soil conservation and on the economic feeding of livestock has caused an increased interest in the production, utilization, and marketing of clover and timothy hay.

Clover and timothy alone and in mixtures continue to form the most important hay crop in the northeastern part of the United States because they are well adapted to the soil, climate, and farm-management practices of that region.

High-quality hay cannot be produced unless the hay is cut at the proper stage of maturity. Clover should be cut at the half- to the full-bloom stage. Timothy should be cut from the early to the full-bloom stage. Mixtures of timothy and other grasses should be cut not later than when the grasses are in full bloom. When clover and timothy are cut at the proper stage of maturity, they can be cured with a higher percentage of green color and feed value.

A certain amount of sweating which is caused by fermentation always occurs in the proper curing of clover and timothy hay and may improve the palatability of the hay. Excessive fermentation destroys the green color and may cause the hay to become musty or moldy.

Farmers have never given the attention to the production of hay that is given to other farm crops; therefore, losses in quality have been high. High-quality hay cannot be produced unless the meadows are kept clean of weeds and other trash, the hay plants are cut at the proper stage of maturity, and the crop is cured and stored as quickly as possible.

In the preparation of hay for market proper consideration should be given to pressing the hay into neat, uniform bales and loading it on trucks or cars so that it will present an attractive appearance to the buyer.

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High-Grade Timothy and Clover Hay: Methods of Producing, Baling, and Loading for Market

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IMPORTANCE OF THE CLOVER AND TIMOTHY HAY CROP

CLOVER AND TIMOTHY HAYS constitute one of the major groups of hay in the United States. They made up about one-half of the total hay acreage in 1919 but less than one-third in 1950. Even with this reduction in acreage, these kinds of hay still occupied 21,309,000 acres in 1950—a larger acreage than alfalfa or prairie hay which are the next two largest hay crops from an acreage standpoint. Most of the clover and timothy hay is grown in the northeastern quarter of the United States (fig. 1).

Clover and timothy and their mixtures continue to be the most important hay crop in the North Atlantic States, and in Delaware, Maryland, Virginia, and West Virginia, but the acreage has been decreasing in the Mississippi Valley States.

Statistics are not collected on the acreage of clover, timothy, and clover and timothy mixtures as separate crops. At present the data on clover and timothy hay in the agricultural statistics cover red, alsike, and Ladino clover, timothy and small quantities of other hays, and all mixtures of timothy and the various types of clovers.

It appears from the data on the amounts of clover seed and timothy seed produced that there has been a distinct shift in the relation of the acreage of clover and timothy to the total acreage of these types of hay. The timothy acreage has declined whereas the acreage of red clover alone and clover-and-timothy mixtures has increased.

[1] E. O. Pollock was senior author of the original edition of this bulletin, which was issued in 1937 when the work was in the Bureau of Agricultural Economics.

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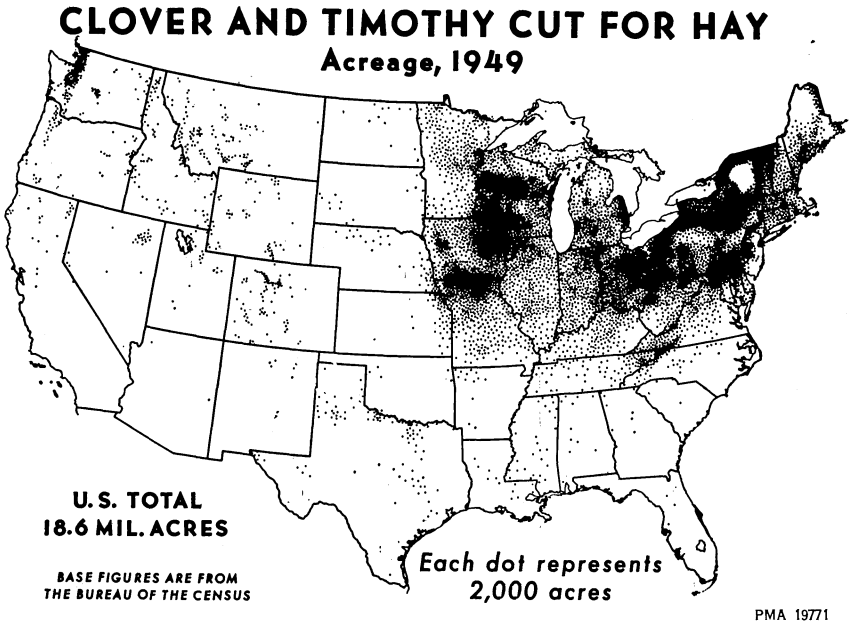

Figure 1.—Clover and timothy hay acreage. The production of clover and timothy hay is confined chiefly to the northeastern quarter of the United States.

The gradual reduction (fig. 2) in the clover and timothy acreage may be due to a number of factors. The most important are the reduction in the number of horses and mules in cities and on farms, and the shift to the growing of other legume hays alone and in mixtures in certain areas. These shifts are indicated by the increase of the alfalfa acreage in the Mississippi Valley States and the lespedeza acreage in Kentucky, Tennessee, Virginia, and Missouri.

Clover and timothy are also grown rather extensively in certain States of the Northwest (fig. 1). The growing of these kinds of hays in those States is confined generally to the irrigated sections and high mountain valleys of Montana, Wyoming, Colorado, and Idaho and the humid districts west of the Cascade Mountains in the States of Washington and Oregon. Although there was a slight decrease in clover and timothy acreage in several of these States during the period 1919 to 1950, the decrease was not as pronounced as in some of the States in the northeastern quarter of the United States.

Various mixtures of clover and timothy are grown in the different areas, depending on whether the meadows are nearly pure clover or pure timothy or a mixture of the two. In the New England States and part of New York the land is left as meadow for 3 or more years. Therefore, hay grown there is chiefly mixtures of timothy and other grasses with small quantities of clover, especially after the second or third year. In certain parts of New York, Pennsylvania, Maryland, and the Corn Belt, the land remains as meadow for 1 or 2 years only. In those areas the hay is made up largely of clover the first year and of timothy thereafter. Even if the meadow is to be left for only 1 year, timothy is sown with the clover as insurance against a complete failure should the clover fail because of disease or winter-

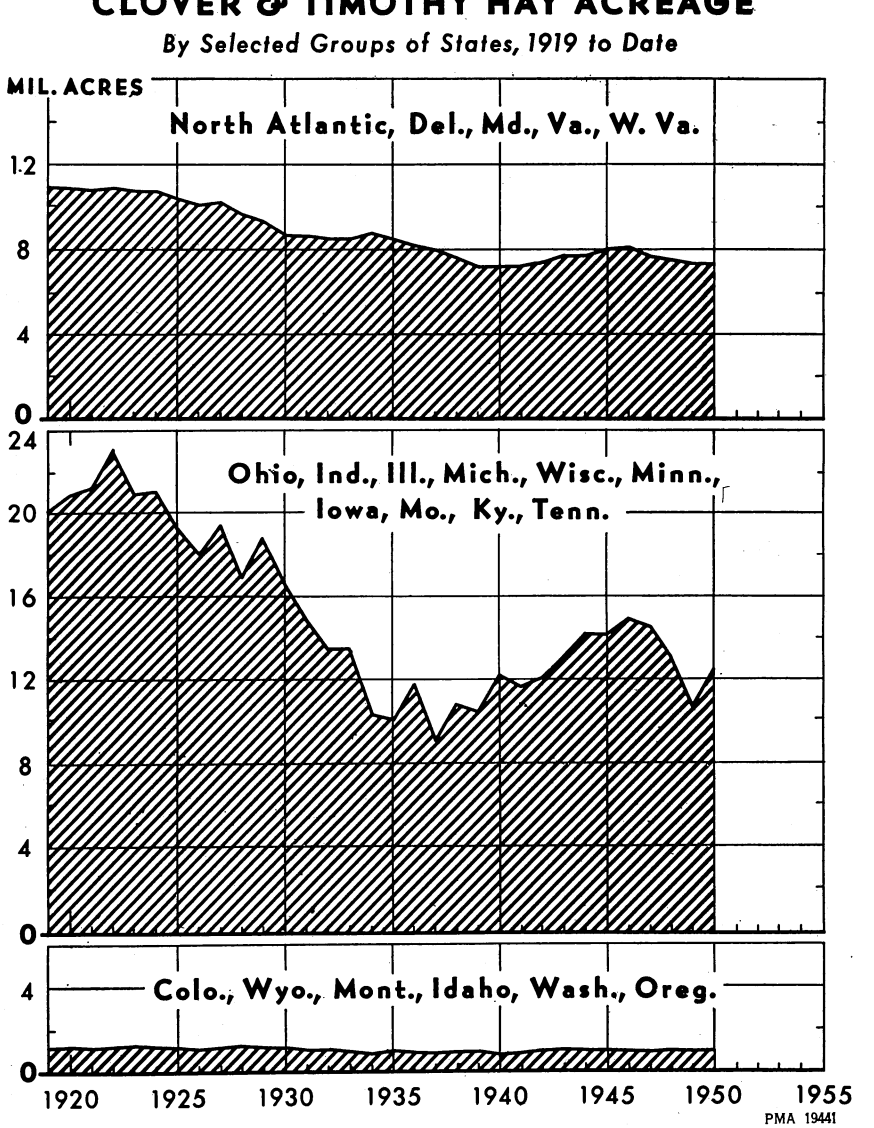

Figure 2.—Acreage of clover and timothy hay in certain groups of States, 1919–50.

killing, which happens occasionally in certain areas. When clover and timothy are grown in a regular rotation, they usually follow some grain crop, such as wheat or oats.

If wheat is followed by clover and timothy, the timothy seed is usually sown in the fall at the same time the wheat is sown and the clover is sown in the young wheat the following spring when the soil is honeycombed by frost so that the clover seed will be covered. If the clover and timothy seeds are sown with the oats in the spring, they are usually sown at the same time the oats are seeded.

Yields of clover and timothy hay per acre vary widely in different localities. Clover or mixtures of clover and timothy outyield timothy under similar climatic and soil conditions. The average yield of clover and timothy hay in the United States in 1950 was 1.38 tons per acre. However, yields of 2½ to 3 tons of timothy hay per acre are often produced around Puget Sound because of the favorable growing conditions.

In those sections in which the clovers and alfalfa do not thrive very well because of soil conditions or other factors, as in much of the North Atlantic States and Delaware, Maryland, Virginia, and West Virginia, timothy will probably continue to be one of the most important hay plants grown. In many of these sections clovers and alfalfa will grow but will not produce and maintain a dense stand. Under these conditions mixtures of one or more of these legumes and timothy, bromegrass, orchard grass, or some other grass suitable for hay will produce a hay mixture that has a higher feed value than timothy alone and will give greater yields per acre.

The clovers, especially red clover, are adapted to the northeastern quarter of the United States for the following reasons: (1) They fit in with a 3- to 5-year rotation including a row crop and a small grain crop; (2) they are not as exacting as alfalfa in soil, nutrient, and lime requirements; (3) as they are seeded in small grain as a companion crop, they will compete with weeds somewhat better than alfalfa; (4) seed can be produced in the area in which they are grown, thus making it possible for the farmer to produce his own seed. The clovers are being used to a greater extent in the Southern and Western States as new varieties which are adapted to these areas are developed.

As a general rule, throughout the area that is adapted to the clovers any well-limed soil that will grow corn will grow a good crop of clover. The nitrogen needed will be taken from the air but the soil should be checked to determine whether it contains a sufficient quantity of phosphorus, potash, and lime. The specific needs for a given farm should be worked out with the county agent or the State agricultural experiment station.

Timothy will probably continue to be the principal tame-grass hay in the northeastern quarter of the United States although orchard grass and smooth bromegrass may increase in importance in many areas. Timothy has always been an ideal grass hay plant for the following reasons: (1) It will grow in a wider variety of soils and climates than any other grass-hay plant and it yields well; (2) it produces seed regularly and prolifically, the seed is easily saved and cleaned to a high purity and is difficult to adulterate, and the cost of the seed per acre for sowing a crop is usually relatively low; (3) it is easily seeded with the usual farm equipment; (4) it makes a smooth, even sod that prevents weed growth and soil erosion; (5) it can be harvested for hay over a longer period than most other grasses because it remains palatable for a relatively long time; and (6) it has value for pasture as well as for hay, although the aftermath following a hay crop is relatively small.

QUALITY FACTORS IN CLOVER AND TIMOTHY HAY

High-grade clover and timothy hay may be defined as hay cut at the proper time, properly cured, with a large amount of natural green

color, and, in the case of clover, with a relatively high percentage of clinging leaves. The hay must be relatively free from foreign material and must not be musty or moldy or have objectionable odors.

Weather conditions often prevent the making of high-grade hay but production practices are usually reflected in the quality of a lot of hay. The quality of many crops of clover and timothy hay is virtually sacrificed as a result of late cutting and improper methods of curing, handling, and storing. Leaf diseases may also reduce quality, especially if the clover is not cut at the proper time.

The quality factors employed in the United States standards for clover and mixtures in which clover predominates are leafiness, color, foreign material, and condition. Leafiness is the most important factor. In the U. S. standards for timothy and mixtures of timothy and clover in which timothy predominates, the quality factors are color, foreign material, and condition. The leaves in clover, like those in alfalfa, have about two and one-half times as much protein as the stems. As the blossoms make up a considerable part of the total weight of the clover, and as they are similar to leaves in protein content, they are considered as leaves in determining the quantity of leaves in clover hay.

For many years before the standardization work on hay was undertaken by the Department of Agriculture, hay was bought and sold largely on the basis of green color. Although little was known of the relationship between green color and the nutritive value of hay, observations by livestock feeders had definitely established that there was a preference in the market for green hay, and that experienced buyers were usually willing to pay a higher price for it. The presence of green color in hay was looked upon as the buyer's insurance against unsoundness and his evidence of the approximate feeding value of the hay.

During recent years feeding tests have established a more definite relationship between green color in hay and feeding value. Experiments conducted by the Bureau of Dairy Industry, United States Department of Agriculture, show that there is a correlation between the green color and the carotene content of hay. When U. S. No. 1 Timothy Hay, which is a grade with a relatively high percentage of green color, was fed to dairy cows as the only source of carotene or provitamin A, the cows remained in good health and reproduced normally. When cows were fed U. S. No. 3 Timothy that had lost most of its green color, because it was overripe or weathered, as the only roughage for more than 6 months prior to calving, they usually dropped immature, weak, or dead calves. When milk from cows that received the U. S. No. 3 Timothy Hay was fed to calves that were normal at birth, they did not make normal growth and died within 3 months. It was also shown that butter color and its vitamin A content vary definitely with the green color and carotene content of the roughage fed. Butter from cows fed U. S. No. 1 Timothy Hay as the sole roughage had a vitamin A value that was approximately twice that of butter from cows that were fed U. S. No. 3 Timothy Hay as the sole roughage.

STAGE OF MATURITY AT WHICH CLOVERS SHOULD BE CUT FOR HAY

The clovers should be cut for hay at or near the time of maximum yield of protein per acre because the feed value of clover is measured largely by the percentage of protein in clover hay.

The Ohio and Iowa agricultural experiment stations reported that the percentage of protein of the clovers declines rapidly from the bud or heading-out stages to full-bloom and more slowly from full-bloom until the seed is mature. The experimental work in Ohio with medium red clover indicates that the highest yield of hay per acre may be expected when it is harvested from the half- to the full-bloom stage, whereas the work in Iowa indicates that the highest yield per acre may be obtained when half of the blossoms have turned brown. The variation between the results at these two stations may be due to a large extent to a difference in the interpretation of the stage of bloom at time of cutting.

An experiment at the Ohio Agricultural Experiment Station gave the following results: Medium red clover cut in the bud stage contained 22.4 percent of protein and yielded 343 pounds of protein per acre; cut when 50 percent of the flowers were in bloom, it yielded 15.9 percent protein and 478 pounds of protein per acre; and cut at full bloom, 14.9 percent protein and 462 pounds of protein per acre. At the Iowa Agricultural Experiment Station medium red clover cut at the bud stage contained 20.5 percent protein and yielded 426 pounds of protein per acre; cut at the full-bloom stage it contained 18.4 percent protein and yielded 512 pounds of protein per acre; cut at the late bloom stage it contained 17.2 percent of protein and yielded 552 pounds of protein per acre; and cut when half of the blossoms were brown it contained 17.3 percent protein and yielded 590 pounds of protein per acre.

It appears desirable, therefore, to begin cutting medium red clover when about half of the plants are in bloom. Cutting should be finished by the time the plants are in full bloom.

Mammoth red clover produces the greatest number of pounds of hay per acre when cut at about the full-bloom stage, but the greatest number of pounds of protein per acre will be obtained if the cutting is done when approximately 50 percent of the plants are in bloom. The cutting of mammoth red clover should also begin when about half of the plants are in bloom and should be completed by full bloom. Mammoth red clover blooms about 2 weeks later than medium red clover or about the same time as timothy. Many feeders object to mammoth red clover hay because of the coarse woody texture of the stems.

Alsike clover, which has a continuous growth habit especially on moist soils, gives the greatest yields of hay per acre if cut when most of the flowering heads have turned brown. The greatest yields of protein per acre are obtained when the plants are cut in full bloom. Alsike clover, when grown alone, has a greater tendency to lodge as it approaches maturity than red clover and therefore should be cut at about the same stage of maturity as medium red and mammoth red clover.

Because of the importance of clover in the mixture, medium red or mammoth red clover containing a mixture of timothy should be cut when the clover is in the half- to the full-bloom stage (fig. 3). Medium red clover reaches the right stage for cutting about 10 days to 2 weeks earlier than the timothy. Mixtures of timothy and mammoth red clover reach the proper stage for cutting at about the same time.

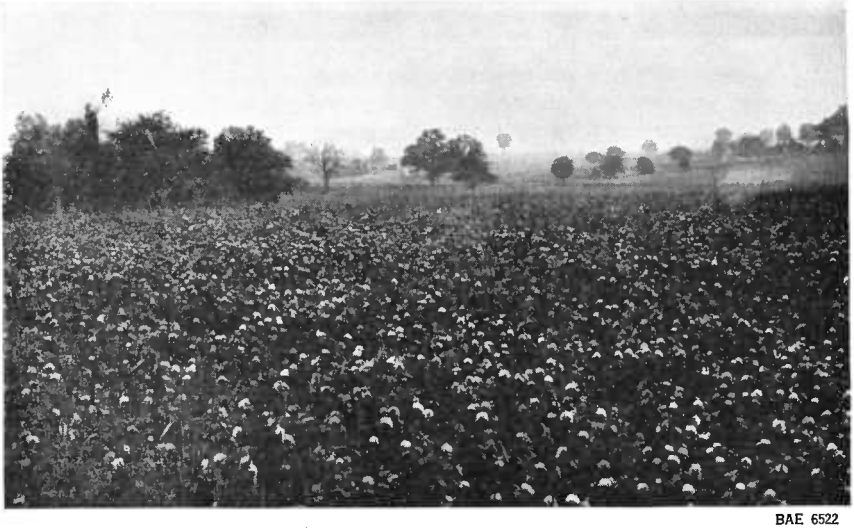

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Figure 3.—A field of clover and timothy. The clover is in the half- to full-bloom stage just ready for cutting.

Alsike clover containing enough timothy to prevent the clover from lodging may be cut for hay when the timothy is in the fully headed-out to full-bloom stage of growth. At this intermediate stage both the clover and timothy will produce the maximum quantity of protein per acre.

When the larger part of the timothy and clover mixture is timothy, cutting should be delayed until the timothy is fully headed out, but should be finished by the time the timothy reaches the full-bloom stage (fig. 4). With this type of mixture it appears desirable to sacrifice the quality of the clover in order to obtain the maximum quantity of protein per acre from the timothy.

EFFECT OF STAGE OF MATURITY AT TIME OF CUTTING ON QUALITY OF TIMOTHY HAY

Timothy should be cut for hay after it is fully headed out but before it has reached the full-bloom stage (fig. 4). Experiments conducted in northern Ohio showed that the percentage of protein declined after the timothy was fully headed and that the yield and total protein declined after the early bloom stage.

The protein content of timothy can be affected by the amount and kind of fertilizer used. In areas where timothy or timothy and grass mixtures are used for dairy feeding the protein content as well as the yield of hay can be increased by proper fertilization.

Work done at the Missouri Agricultural Experiment Station on the best time for cutting timothy gave average results per acre as follows: Timothy cut when coming into bloom had an average of 1,996 pounds of total digestible dry matter, of which 135 pounds were protein; cut in full bloom, 2,175 pounds of total digestible dry matter, of which 147 pounds were protein; cut with seed in dough, 1,914 pounds of digestible dry matter, of which 98 pounds were protein;

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Figure 4.—A good stand of timothy and clover mixed hay which is being cut when the timothy is in the early- to full-bloom stage.

and cut with seed ripe, 1,775 pounds of digestible dry matter, of which 92 pounds were protein.

Timothy cut from the fully headed-out to the bloom stage has more feed value per acre than timothy cut when it has passed the bloom stage. It also can be cured with a higher percentage of green color, which increases its market value as well as its feed value. As the timothy plant becomes more mature much of the protein and carbohydrates in the leaves and stems is transferred to the roots and seeds, thus increasing the percentage of crude fiber in the stems and leaves and lowering the feed value of the hay. When the leaves have ceased to function they fade and turn brown. The quality or grade of the hay is therefore reflected to a considerable extent by the presence or absence of green color.

A study made by the Department showed that when timothy was cut at nearly full bloom the leaf blades contained 11.6 percent protein, the leaf sheaths 5.7 percent, and the stems 4.8 percent. This study also indicated that the protein content of these parts of the plant continued to decrease as the timothy became more mature and that the proportions of the various parts of the timothy plant also changed as the plant approached maturity. The leaf blades dropped from approximately 30 percent of the total weight at nearly full bloom to 10 percent when the heads were fully mature.

In many areas farmers are cutting hay in which timothy predominates, at the prebloom stage of maturity. This is especially true if the hay is to be used for feeding dairy cattle. A survey covering 3 years of hay production in New Jersey showed that 76 percent of the samples in which timothy predominated were cut at the prebloom

stage, 4 percent at the early bloom stage, 8 percent at the late bloom stage, and 12 percent at the seed stage. Some of the samples that were placed in the prebloom group were cut just as the heads were emerging from the boot.

Grasses other than timothy that are sown with or occur naturally with timothy mature earlier than timothy. These grasses also lose their feeding value much more rapidly than timothy after they reach the bloom stage. This makes it necessary to cut timothy and grass mixtures when the grasses have reached the full-bloom stage without regard to the maturity of the timothy so that the mixture may retain its palatability. The nutritive value of such grasses as redtop, orchard grass, and bluegrass, if cut at the proper time, will equal or nearly equal that of timothy. Bromegrass, if cut at the proper stage of maturity, is superior to timothy in nutritive value.

RELATION OF MATURITY AT TIME OF CUTTING TO COLOR

Early cut hay will retain a larger amount of green color than late-cut hay cured under similar conditions. Clover that is cut from the half- to full-bloom stage will usually have a large amount of natural green color. If it is allowed to stand until after full bloom the heads will turn brown and leaf diseases may cause the leaves to turn black or drop off. This type of hay will have a dull or greenish-brown color.

From the time timothy reaches the fully headed stage until it reaches the full-bloom stage there is no noticeable loss of green color due to maturity. When the plants are allowed to stand beyond the full-bloom stage the green color fades rapidly. The leaves, beginning at the bottom, gradually turn brown and the stems become greenish yellow, then straw colored, and finally distinctly brown.

Early cut hay may lose some green color during the curing process and still retain sufficient color for the No. 1 grade. If late-cut hay, which has lost some green color before being cut, loses any color during the curing process it usually will fall into the No. 2 or No. 3 grade on the factor of color.

EFFECT OF WEATHER DAMAGE ON QUALITY

If clover and timothy hays are cut and left in the swath or windrow for any length of time they will sun-bleach and lose some of their natural green color. Sun-bleached hay is often produced in those sections in which it is a common practice to dry the hay fully in the swath before raking. The exact effect of sun-bleach on the feeding value of hay is not definitely known. It decreases palatability, however, because the hay becomes dry and brittle, and causes a loss of vitamin A through a reduction in green color. Sun-bleaching causes the hay to turn a bright yellow color instead of the natural green color. This lowers the grade and affects the sale value. Small quantities of sun-bleach in early cut hay usually do not lower the green color below the minimum requirements for the U. S. No. 1 grade.

Slight discolorations in clover and timothy hay are often caused by dew. Even one or more heavy dews may be enough to lower the grade, but ordinarily discolorations caused by a light dew will not materially lower the feeding value provided the hay is properly cured. If the

discoloration is considerable, the appearance as well as the feed and market value are likely to be affected.

Clover and timothy hays that are rained on after they are partly or completely cured lose their feeding value very rapidly. The extent of the loss depends on the duration of the rainfall. A light shower on freshly cut, unwilted hay will cause less damage than the same amount of rain on hay that is partially or completely cured. Light showers will reduce the amount of green color and will damage the hay to a certain extent because the hay will cure more slowly. If the shower is immediately followed by warm, sunny weather, the destruction of green color is hastened.

The evidence of slight damage is found in the yellow or straw-colored discolorations. Severe weather damage and extensive loss of color are commonly caused by heavy rains or numerous showers when hay is in the swath or windrow. The evidence of severe weather damage is found in the dark-brown or faded colors or stains.

The losses from weather damage can be prevented to a certain extent by mow finishing to complete the curing of hay. Under this system the hay is cured in the field until the moisture has been reduced to 35 or 40 percent. The hay is then placed in the barn or shed which is equipped with a slatted floor and a fan. After the hay has been placed on the slatted floor, air is forced through the hay to remove the excess moisture and complete the curing. In some cases the air is heated to increase the speed of curing.

EFFECT OF FERMENTATION ON QUALITY

Fermentation, often referred to as sweating, occurs in hay that is baled, stacked, or mowed before it is completely cured. In fact, all hay will sweat a little after it is stored unless it is overdried in the field. The sweating of newly harvested hay is, therefore, a natural process through which the hay passes before the curing is completed and may increase its palatability by softening the stems and improving the aroma. Clover and timothy hay that has been properly field cured before being stored will go through a moderate sweat in the bale, stack, or mow with little or no loss of green color.

If the hay is stored when it contains too much moisture, either sap moisture or rain or dew moisture, excessive heating will take place and the hay will lose much of its green color and may become musty and moldy. Hay that is severely discolored from stack or mow sweating is known as stack- or mow-burnt hay. Hay which sweats excessively in the bale may have discolored cores in the center of the bale, whereas the outside where the air has prevented the hay from heating will not be discolored. Little is known about the effect of sweating on the feed value of clover and timothy hay but if the sweating is so severe that the hay is mow-burnt or musty and moldy the quality is materially reduced.

Fermentation of wet or undercured hay may cause high temperatures to develop. Such hay, which is warm to the touch and gives off a strong sour odor, is called heating or hot hay. The temperature of hot hay occasionally becomes high enough to cause spontaneous ignition. Baled hay that is heating may be reconditioned through aeration, but in most cases if it is distinctly hot it will become musty

and moldy. Must and mold are usually associated. Must is the sour odor usually accompanying moldiness and is evidence of a damaged condition in the hay even though the mold itself is not visible. Molds are the fungus plant organisms that develop in hay when moisture and temperature conditions are favorable for their growth.

FOREIGN MATERIAL IN CLOVER AND TIMOTHY HAY

Foreign material in clover and timothy hay includes weeds, coarse woody plants of little or no feed value, cornstalks, grain stubble, chaff, and other objectionable material that occurs naturally in hay. In order to take care of normal production conditions, the timothy and clover standards permit a maximum of 10 percent of foreign material in the grade U. S. No. 1, 15 percent in the grade U. S. No. 2, and 20 percent in the grade U. S. No. 3. Hay that contains more than 20 percent but not more than 35 percent of foreign material is placed in Sample grade.

Foreign material is usually rejected by livestock and remains uneaten in the feed manger. When hay is bought by a livestock feeder he does not get full value for his money if the hay contains much foreign material. It is therefore just and fair that the grade and, thus indirectly, the price should be lower when the hay contains much of this kind of material.

It is recognized that a small quantity of weeds and other foreign material occurs naturally in the production of hay and that meadows that are free from weeds are uncommon. Excessive foreign material in clover and timothy hay, especially clover, is due to foul land, land of low fertility, and the use of low-grade seed. Certain types of weeds, such as daisies and buckhorn, are difficult to detect, particularly in clover and clover and timothy mixtures because the stems of these weeds are often of the same color as the clover stems; and unless one is familiar with them they will be overlooked or considered as clover. Certain other types of foreign material such as grain stubble and cornstalks tend to give baled hay a bad appearance in proportion to the quantity present by weight. The percentage of weeds in tightly compressed bales is often difficult to determine.

Foreign material that causes mechanical injury or is poisonous to livestock is not a serious problem because very few of these plants occur in clover and timothy meadows.

PRODUCTION OF HIGH-QUALITY CLOVER AND TIMOTHY HAY

On many farms the hay crop receives less thought and attention than field crops like corn, wheat, oats, tobacco, or potatoes. But if hay is to be relied upon as a cash crop or used as the basis of a dairy- or stock-feeding program, it must be managed with the same degree of forethought and attention as the good farmer gives to any other cash crop. Farmers grow a large quantity of feed in the hay crop and then lose much of the feed value through faulty curing practices. If farmers were able to harvest the hay crop when it reached the proper stage of maturity and then cure and store it without any loss, the feed value of the hay crop would be increased by at least 25 percent.

High-quality hay cannot be produced for either market or home

use unless the producer plans ahead to have clean meadows, to cut the hay at the proper stage of maturity, to cure and store the crop as quickly as possible, and if produced for market, to bale and load the hay according to market demands. The producer who plans to use the hay as feed for dairy cattle, stock cattle, or sheep should store it so as to prevent spoilage in the mow or stack. This will preserve the feed value of the roughage, which in turn will reduce the quantity of concentrates necessary to give maximum gains and milk production at a minimum cost. The cost of producing low-quality hay is just about the same as the cost of producing high-quality hay and the feed value or return per dollar invested is much lower.

It does not pay, ordinarily, to ship low-quality hay to market because of high transportation costs and low net returns. Feeding low-quality hay to farm animals will usually reduce the returns to the farmer or livestock feeder for meat and dairy products. Some of the important factors that have an effect on hay quality are here considered.

GOOD STAND NECESSARY TO HIGH-QUALITY HAY

High-quality hay can be produced only in a good meadow which has been properly fertilized, is free from weeds, and has a thick stand of adapted legumes and grasses. To obtain a good stand the rate of seeding per acre recommended by the forage-crop authorities of the State agricultural experiment stations should be followed.

Wherever soil conditions permit, the kind of pure hay or mixed hay should be grown that is known to be in the greatest demand at the markets available to the producer and shipper, or that will give best returns in the dairy- or livestock-feeding program.

CURING METHODS TO PRESERVE LEAFINESS AND COLOR

Hay-making methods necessarily must vary with the kind of hay, the local climatic conditions, the farm conditions and buildings, and the labor and machinery available. The proper curing of hay depends on the judgment, energy, and experience of the farmer. A few of the most common errors made in curing and storing clover and timothy hay—which are reflected in the low quality of hay produced—are discussed.

In many areas, it is a common practice to cure the hay completely in the swath and then to rake it into windrows shortly before it is baled or hauled. On bright, hot days this method is conducive to swath bleaching, a loss of green color and carotene, and overdrying of the leaves of clover that are shattered and lost when the dry hay is raked.

These losses can be prevented to a considerable extent by the intelligent use of the side-delivery rake, especially when heavy mixtures of clover are being handled. When hay is raked into somewhat cylindrical windrows with the side-delivery rake, while the hay is tough, many leaves within the loose roll will be protected from overdrying and will cling to the stems. Furthermore, a large part of the crop will cure without bleaching.

During the last few years there has been considerable interest in

the barn curing of hay. This method consists of placing partly cured hay in barns equipped with air ducts on the floor of the mow through which air can be forced from a large fan. This air prevents the hay from heating and carries off the excess moisture so that the hay is cured in the mow. As much as 8 feet of hay can be placed on the ducts at one time and after this hay has been cured an additional 8 feet can be placed on top and cured in the same manner.

When this method is used the hay should be cured in the field until just before the clover leaves are dry enough to shatter unless the hay must be taken up to prevent rain damage, in which case the hay could be put into the mow with somewhat more moisture than usual.

Loss of quality from excessive swath bleaching, or fermentation in storage, or from poorly built stacks can be controlled by proper handling. Losses from rain damage in the swath and windrow cannot usually be controlled, and at best can be minimized only by proper planning.

MINIMIZING RAIN DAMAGE TO HAY

Rain damage while hay is in the swath or windrow is the hay producer's greatest bugbear. Sometimes summer showers or unexpected heavy rains spoil the plans of the best farmers. One practice that should always be followed is to cut only the quantity of hay that can be handled with the available crew before it becomes overdried. Hay that is left in the swath or windrow after it is thoroughly cured loses quality very rapidly.

Over a period of years, careful planning of the cutting and raking operations and the use of modern machinery to move the hay from the windrow to the stack or mow will eliminate much of the severe loss caused by rain damage.

STORAGE METHODS TO PRESERVE QUALITY

Timeliness is an important factor in handling hay to preserve quality. The question is often raised as to when hay is cured enough for safe storage and what rule-of-thumb methods a farmer can use to determine the moisture content. There are no simple methods for accurate moisture determination, but the following rule-of-thumb methods are often used by practical farmers to determine whether the hay is cured sufficiently for storage.

One method is to twist a wisp of hay in the hands. If the twisted hay is tough and there is evidence of moisture where the stems are broken the hay is considered too sappy for safe storage. If the stems are slightly brittle when broken and there is no evidence of moisture when the stems are twisted, the hay can be stored without danger of spoilage. Another method that can be used on clover hay is to scrape the outside of the stems with a finger nail. If the outside bark can be peeled from the stem the hay is considered undercured. If it does not peel off the hay is dry enough for storage.

Experiments carried on by the State agricultural experiment stations indicate that hay containing 22 to 25 percent of moisture can be stored without danger of spoiling in storage. Farmers who are experienced in curing hay do not find it difficult to determine when the hay is ready for storage, provided it is cured uniformly, but they

are careful about storing it if there are undercured bunches mixed with the cured hay. They believe that these undercured bunches are likely to be the center of heating areas or pockets that may become moldy or may even cause spontaneous ignition. Hay that is stored while still slightly tough goes through a sweat in the mow or stack, which usually improves its palatability.

In Virginia, West Virginia, and parts of Maryland, clover and timothy hay are often stacked by hand, in tall, narrow stacks, about a central pole. These stacks usually contain 2 to 4 tons of hay. Such stacks weather badly and often become severely stained. It is a poor practice to store hay in such small stacks because so much of it is exposed to weather. Clover and timothy hay can be stacked directly from windrows with the sweep rake and stacker. Stacks holding 10 to 15 tons can be built easily with either of several types of hay stackers. The percentage of weather-damaged hay to total stack tonnage is much less in large than in small stacks. The risk of damage to the center is small if the stack is built with side-wall bulges 3 to 4 feet above ground level, and is drawn to a peak at the top. In areas of heavy rainfall, straw or grass hay may be spread over the top to assist in shedding the rain. A layer at least one foot thick should be used for this purpose.

In the North Atlantic States, and to a certain extent in the Mississippi Valley, clover and timothy hay is usually stored in barns that are used to house the livestock or are used entirely for hay. Barn-stored hay will not be damaged further by weather if the barn has a good roof, but great care must be taken to control the moisture content and thus avoid loss from fire caused by spontaneous ignition.

Considerable interest has been shown in the practice of chopping hay into short lengths at the time of storage to reduce the storage space and the labor involved. The indications are that the cost of using power machinery for chopping and storing the hay will just about offset the saving in labor. Two to two and one-half times as much chopped hay can be stored in the same space as required for long hay, and chopped hay can be removed from the mow for feeding much easier. But the keeping qualities of the hay are influenced by the depth of the hay in the mow, its texture, and length, as well as by its moisture content. Since more chopped hay than long hay can be stored in a given space, barns that have been built for long hay must be strengthened if they are to be used for chopped hay. This is especially true if the barn is the type with stables under the hay mow.

WINDROW BALING OF HAY

In recent years considerable clover and timothy hay has been baled from the windrow with the pick-up baler, and this practice will probably continue to increase. Hay must be somewhat drier to be baled from the windrow than to be stored loose. When clover hay is dried sufficiently to be baled from the windrow, the leaves are likely to be shattered to a major degree in the baling operation. The period during the day when the hay is just right for windrow baling without serious shattering is rather short. Hay that is baled before it is dry enough is likely to heat or sweat in the bale, and as a result may lose some green color and may become musty and moldy. Hay that is too

dry when it is baled will be broken and the leaves will be badly shattered. Since weather is an important factor in the curing of hay, any practice that extends the curing period increases the danger of weather damage to the hay.

Hay that is baled from the windrow should be piled on edge and spaces should be left between the bales so that air can circulate around them. This method of piling windrow-baled hay will assist materially in preventing spoilage due to spontaneous heating.

PREPARATION OF HAY FOR MARKET

Care in the preparation of hay for market will insure a better quality and hence a higher price for the producers. Buyers are acquainted with the factors of quality of hay—such as color, foreign material, and condition—that have a direct bearing on its feeding value. Hay should be baled and loaded to meet the demands of the market where it is to be sold.

The hay trade objects to handling windrow-baled hay because of the low density of the bales and the difficulty of loading the required tonnage into railroad cars. Truckers also object to lightweight windrow-baled hay because of the limited tonnage that can be transported and the instability of the load.

Bales of market hay should be neat in appearance and tightly tied. Ragged-looking bales loosely or unevenly tied sometimes bring a smaller price merely because they are unattractive and the bales break when handled. The bunches of coarse weeds and damaged hay that are often found mixed with good hay should not be fed into the press. Slugs containing weeds or other foreign material or unsound hay can hurt the appearance of good hay.

Hay that has been properly cured and stored but that has received enough moisture from snow or rain during the baling or loading period to cause it to heat, while in transit, often arrives at the market. Such hay is usually unsound and is either rejected or sold at a discount. Shippers should bale and load only during days of bright weather and should protect the piles of bales from snow or showers.

The baling of hay, especially legume hay, from stacks or mows on days when the humidity is relatively high will minimize the loss of leaves and breaking of stems. Hay baled during the winter when the weather is windy or when the temperature is below freezing is often badly shattered and broken.

Much of the field-baled hay shipped to market during the harvest season arrives in a hot or moldy condition. Sweating takes place in the bales during transit or in the warehouse, and the tightly packed bales are likely to heat and become moldy. If hay that is to be baled from the windrow is overdried in the swath to prevent heating, the loss of color and, in the case of clover hay, the loss of leaves, lower the quality.

LOADING HAY ON CARS OR TRUCKS

Baled hay piled in the barn or in the field can be easily graded and sorted before it is loaded for shipment. In preparing this hay for market, all widely different classes and grades should be separated.

If any bales of distinctly low-quality hay have been pressed with bunches of weeds or spoiled hay, they should be withheld from shipment. If different classes of hay, such as Timothy Hay, Timothy Light Clover Mixed Hay, or Clover Hay, have been baled from different meadows, the various classes should be separated as far as possible because it is not good practice to load a number of classes of hay in the same car or on the same truck. Similarly, if a part of the hay which has been cured without rain damage grades U. S. No. 1 and another part, because of excessive sunbleach or moderate rain damage, grades U. S. No. 2, it is best to separate the two grades before loading. Buyers who order a car or truck lot of hay of any specific grade expect to receive a uniform load complying with their specifications and are not satisfied with mixed lots.

If bales of hay of different grades or classes are loaded promiscuously in the same car or on a motortruck, it is very difficut for the inspector at destination to place a proper grade on the entire lot. When bales of two distinct grades or classes are intermingled, he cannot average the grades and designate one grade for the entire car or truck lot. The best he can do is to count the bales of each class and grade and certify that he inspected a definite number of bales of the various classes and grades. In case of doorway inspection, the presence of bales of different grades raises doubt in the buyer's mind as to the uniformity of the entire carlot; hence the hay may not sell to the best advantage. The better policy is to load hay of uniform grade because hay merchants can sell uniformly loaded cars or truck lots for better prices than nonuniform lots.

A shipper does not always have enough hay of uniform grade to fill one car or truck or to complete a shipment of several car or truck lots. Under these conditions the best plan is to load bales of one class or grade in one end of the car and bales of a different class or grade in the other end. The total number of bales loaded in the car, together with the number of bales of each class or grade, should be stated plainly on the shipper's invoice. This practice of describing the hay shipment fully and frankly on the invoice is appreciated by receivers and helps the shipper to market hay advantageously. Ultimately such a practice, consistently followed, builds up a reputation for the shipper that creates a demand for his product.

On the other hand, the policy of loading U. S. No. 1 hay in the car doorway and concealing low-grade hay in the ends of the car, or the practice of loading bales of damaged hay in every car or truck, believing they will be overlooked, usually brings trouble and causes loss to the shipper. Wherever plug inspection is used (which means opening up an alleyway through the tiers of bales in the car for inspection) the variation in grade is sure to be discovered to the eventual, if not immediate, detriment of the shipper. Even under doorway inspection, plugged carlots of hay are sure to be discovered when the hay is unloaded, and the buyer will call for another inspection on the hay that was not inspected in the doorways.

Bales of newly harvested hay should be placed on edge in the car and space left between the tiers of bales and between the top bales and the roof of the car so that the air can circulate more readily and reduce the possibility of heating while the hay is in transit. It is best to have the ends of the bales face the car doorways or the outside of the